

I CLAIM:

91.(NEW) An apparatus for continuously monitoring & controlling cyclic streams of various fluids, and of heat, in and out of four vertical, fluid-flow compartments, separated by at least two coaxial thermal barriers, in a multilateral well, equipped with a cemented casing pipe connected, via cemented curved liner pipes, to a plurality of quasi-horizontal branch-wells, equipped with perforated liner pipes, for keeping said casing pipe at a below-freezing temperature, within a pre-existing cold environment, while heating to high temperatures six fluids within said horizontal branch-wells, located in a originally cool heavy-oil reservoir, underlaying said cold environment and linked to the lower part of said multilateral well casing pipe by said curved thermally-insulated liner pipes extending to a radial distance of at least five hundred feet from the base of said cold environment, so as to:

a) raise the fluidity of three heavy-oil reservoir fluids (formation water, heavy-oil, solution gas) with three imported fluids (cold gas, steam and condensate water) by injecting at the well-head, a hot wet steam supplied at the surface, into a large portion of said reservoir, for heating its fluids' entire content, above said quasi-horizontal branch-wells, and

b) to re-heat and lift to the surface the fraction of said heated reservoir fluids, produced from said reservoir portion drained by the producing branch-wells, mixed with an entire stream of re-heated gas from said first fluid-flow compartment, wherein,

- said four compartments, inwardly-listed, along a radial direction, toward the multilateral well's axis, reach equilibrium temperatures, ranging from about -20 to -10 degrees C, in said, outermost, first

compartment, in close thermal contact with said cold environment, and to about 150 degrees C in said gas-filled second compartment, at near atmospheric pressure, and up to 360 degrees C in a third and a fourth thin inward compartments, respectively gas-filled and steam-filled, comprising:

- a first, coldest, fluid-flow compartment, annular, between said vertical casing pipe and said first thermal barrier,
- a second, warmer, gas-filled compartment, annular in the lower part of the casing, and within the curved gas tubing of the insulated portion of each of the branch-wells, composing said first thermal barrier, containing annular production channels and a plurality of pipes dedicated to lifting, to said well-head, via shared annular production collector channels, dedicated to conveying to the well-head the three hot fluids, produced from said portion of heavy-oil reservoir, previously heated by injection of very hot wet steam, and their lift-fluids,
- a third, hot, gas-filled fluid-flow compartment, annular and thin, at low pressure, containing monitoring sensors, adjacent to the inner side of said second thermal barrier, extending from the well-head to the lower end of each branch-well's curved tubing and within the space between said second thermal barrier's cover pipe and the fourth fluid-flow compartment,
- a fourth, very hot steam-filled fluid-flow compartment, coaxial tubular, highly pressure-resistant, preferably jointless, dedicated to carrying from the surface a high-pressure, very hot steam into each of those said branch-wells which operate in the steam injection mode.

92.(NEW) The apparatus of claim 91, supplied by a continuous cold

gas stream flowing downward from said well-head, wherein:

- said gas in said first fluid-flow compartment, subcools the cold environment, adjacent to said first compartment, so as to strengthen the said cold environment crossed by the multilateral well casing, and said gas stream, when re-heated downhole by mixing it with nearly continuous streams of hot heavy-oil and of hot steam condensate, said gas returns to the well-head, thereby lifting hot heavy-oil and other produced liquids from a plurality of branch-wells to conventional surface separators and said gas provides, after separation, a large portion of the boiler-fuel required to make steam for heating said reservoir portion and its fluids content so as to drain and recover a significant fraction of said hot heavy-oil, and wherein:

- said second compartment, preferably filled with a stagnant gas, at a near atmospheric pressure and limited on its inner side by said shared annular production collector channel, conveys to the well-head a mixture of hot reservoir fluids, produced from all the branch-wells operating in the production mode, together with the entire re-heated lift-fluid streams, at a nearly constant rate, with minimum external heat loss, and wherein:

- a second thermal barrier occupies the space adjacent to the inner pipe of said annular production collector, filled with multi-layers of said super-insulation, sealed within a supporting steel pipe and a second metallic cover pipe, and with auxiliary flow-control devices, downhole and at the wellhead, optimizes the cyclic periods durations, to regulate the production flow-rate within the production collector channel within said second compartment, at minimum heat loss to the cold environment, and wherein:

- said third fluid-flow compartment continually monitors and records

multiple data: pressure, temperature and the near-absence of water content of the gas filling said third fluid-flow compartment, from which said optimized cyclic period durations are derived, by a computer-controlled system at the surface,

- said fourth fluid-flow compartment, steam-filled, at high pressure and high temperature, directly coupled to a steam generator outlet, almost-continuously conveys steam of high quality, downhole, for safety and reliability of a high-energy process, within the multilateral well.

93.(NEW) The multiple uses of fluids in the apparatus of claim 92, wherein:

- said mixture of re-heated lift-fluids and hot reservoir fluids (oil, water and solution gas), continuously produced from branch-wells in the production mode and carried to the well-head, within said second compartment, via a shared production collector channel, finally processed in separators, provides oil for shipment, plus fuel and water for generating steam and electric power, in close proximity of the multilateral well site, and

- said gas circulating in a close circuit, from the well-head, and back, in said third fluid-flow compartment, together with proper downhole sensors, enables to detect, locate and repair any potential steam leak into said second thermal barrier's insulation.

94.(NEW) The apparatus for avoiding external heat losses and for improving fuel economy of claim 93, wherein:

- said first thermal barrier consists of an intermediate pipe supporting a sealed first annular layer of thermal "super-insulation",

as defined by its very low thermal conductivity, due to its nanoporous structure, combined with a reduced transfer of radiant heat, so that the fluid temperature in said first fluid-flow compartment always remains much below freezing, thereby sub-cooling the surrounding cold environment, beyond said outer casing,

- said supply of a pressurized cold gas stream, actually, gains heat from the cold environment, and the same gas stream's expansion, facilitates the liberation of solution gas from said hot heavy-oil stream; both gas streams, mixed together, provide the energy required for lifting the liquids production stream to the well-head and, after their recovery from the separators, they contribute most of the required boiler-fuel, at a low total cost.

95.(NEW) The apparatus of claim 92, applied to cold environments, Onshore, in the Arctic, where known heavy-oil reservoirs are located below a Permafrost zone of about 1,800 ft-thickness, and Offshore, to large heavy-oil reservoirs, discovered but not exploited, below a cold deep sea, wherein the insufficient fluidity of the heavy-oil in said reservoirs prevents it from reaching commercial-production.

96.(NEW) The apparatus of claim 92, for controlling, or interrupting, flow of fluids, and of heat, downhole, including various pre-fabricated elements, shipped to and installed, on-site from the earth surface, Onshore or Offshore, in various parts, listed in the order of their installation:

- part 1: the well-head and the cemented

casing pipe of a substantially vertical heavy-oil well, crossing a cold environment, and said vertical well casing pipe connecting in its lower part, downhole below said cold environment, to:

- part 2: a plurality of cemented branch-wells, each presenting a curved portion of thermally-insulated liner pipe string, and each connecting to:

- part 3: a nearly horizontal, un-insulated, perforated portion of a liner pipe, in each branch-well, and wherein:

for each branch-well, said apparatus includes two main connecting modular tubular elements, installed by means of a conventional rig:

respectively, the first element within said curved part of said liner pipe string, and the second element within a portion of said insulated vertical casing, dedicated to said branch-well, providing said downhole flow-connectors:

A. to connect both said modular elements with a quasi-horizontal tubing string, within part 3, hung in said branch-well's perforated liner and via the non-perforated, cemented curved liner string of part 2, to the annular third compartment of part 1, around said horizontal tubing string, in said liner pipe,

B. to connect both said elements with a vertical tubing string, behind a sealed super-insulation of thermal conductivity and radiant heat transfer of 25 milli-Watt/meter-degree K, at up to 300 degree C, designated as the second thermal barrier, and dedicated to conveying downwards a stream of wet steam from said vertical well's well-head to the most distant end of said horizontal tubing string,

C. to connect both said elements through said third fluid-flow compartment, at near-atmospheric pressure, used as a

thermally-insulated tubing string, behind a sealed super-insulation, designated as the first thermal barrier, and said production collector pipe dedicated to transporting upwards the hot fluids, produced from said branch-wells, to said vertical well's well-head,

D. to connect both said first and second elements with one or more oil-lifting fluid vertical feeder tubing strings, dedicated to carrying downwards a pressurized cold stream of oil-lifting fluid, from the vertical well-head via the casing's first annular fluid-flow compartment around said super-insulated tubings, to the said two elements of each branch-well, and for providing said downhole flow-interruptors,

E. to periodically interrupt, with surface-operated valves, or with retrievable plugs, in said apparatus, the respective flow-streams:

a) of steam from the surface into said quasi-horizontal tubing string, and, successively:

b) of heated oil-lifting fluid from said curved liners up to the surface, and

c) of reservoir fluids produced from the tubing pipes of said branch-wells into said apparatus up to the well-head.

97.(NEW) The pre-fabricated apparatus of claim 96, installed in each branch-well and in a dedicated portion of said vertical well casing includes a first modular element, and a second modular element,

wherein,

said first modular element includes means :

a) to establish connections to a conventional tubing, installed in the quasi-horizontal part of each said branch- well,

b) to establish connections to the annular space around said

conventional tubing, within said branch-well,

c) to deliver steam into said annular space, from said second modular element, for the subsequent injection and soaking of said steam into said heavy-oil reservoir,

d) to establish connections to said second modular element of said apparatus, located above said first modular element, primarily within said portion of the vertical well casing dedicated to said branch-well,

e) to convey a heated oil stream flowing from said reservoir into said conventional tubing and into said tubing's annular space, via the first modular assembly element, to said second modular assembly element, using a natural steam-lift and various artificial oil-lifting systems.

98.(NEW) The apparatus of claim 96, wherein a second modular assembly element, including parts two and three of said apparatus, and connected to the first modular assembly element of said apparatus, includes, in its part two:

- a production collector pipe, equipped, at its bottom end, with a second sealing stinger, matching the second polished-bore-receptacle,

- an oil-lifting fluid supply tubing, equipped, at its bottom end, with a third sealing stinger, matching the third (PBR)

polished-bore-receptacle, and connected to a third part of said second modular assembly element of the apparatus for said branch-well; and said apparatus includes, in its part three, from the bottom-up:

- means for remotely operating said natural steam-lift and artificial water-lift or oil-lift systems in the sequential steam



injection, steam soak and oil production modes, using various combinations of said branch-flow connectors,

- means for automatically interrupting said first branch-flow connectors, when said annular space is filled with lower density fluids, such as steam or oil-lifting fluid of low density,

- means for establishing the following branch-flow connectors by opening valves or by plug removal,

- A. from the first annular compartment to a coaxial, un-insulated, production collector pipe, when said first annular compartment is mostly filled with liquids (oil and water),

- B. from said production tubing to a central, insulated steam tubing, during the steam injection period, in said branch-well,

- C. from said production tubing to said central production collector pipe, during the branch-well's production period,

- D. from said production tubing to an oil-lifting fluid supply tubing, parallel to the production tubing, and located in a different radial plane than said production tubing,

- E. from said oil-lifting fluid supply tubing to a vertical string of oil-lifting fluid feeder tubings, rising through the multi-tubular packer at the top of said casing annular space's portion, dedicated to said second and third elements of said branch-well's apparatus, and crossing those portions of the casing's annular space stacked above the annular space of said branch-well, and dedicated to other branch-wells.

99.(NEW) The apparatus of claim 96, wherein said flow connectors and flow interruptors for remotely operating said steam-lift, said

oil-lifting and water-lifting systems in the sequential steam-injection, steam-soak and oil-production modes, using said branch flow connectors, include, from the top down:

A. a retrievable plug, located in a second landing nipple, in the production tubing, closing said fifth branch flow connection, except when logging or cleaning tools are to be introduced into said branch-well's production tubing,

B. a surface-operated conventional "on-off" valve opening or closing said fourth branch flow connection of said oil-lifting fluid supply tubing with said oil-lifting fluid feeder tubing string,

C. a surface-operated 3-way valve, vertically located in the production tubing, below said second landing nipple and plug, either directing a production fluids stream upwards into said third branch flow connection to the production collector pipe, or directing steam downwards from said "super-insulated" steam tubing, via said second branch flow connection, into the branch-well's production tubing;

and wherein said means for, automatically, closing said first branch flow connection, from said casing annulus portion to said production collector channel, include:

- a float valve; or a standing valve, set in a gas-lift valve mandrel within said oil-lifting fluid supply tubing, from which said valve automatically directs, by an artificial oil-lifting process a stream of production fluids from the casing annulus portion, via said first branch flow connection, to the production collector pipe, when the level of high-density produced liquids is high within said casing annulus portion, above said liner stub, and said float valve or standing valve also closes said first branch-flow connection, when

said produced liquids level is low, due to the accumulation of steam, of gas, or of oil-lifting fluid, within said casing annulus portion, during the steam injection period, and by a natural steam-lift, during the steam-soaking period.

100.(NEW) A dedicated super-insulated tubular assembly, for conveying wet steam, with minimum heat losses, from a generator at the surface, to one or more of a plurality of branch-wells, connected to a single large cemented oil well casing pipe, hung from a large single well-head, wherein,

said tubular assembly includes, radially, from the axis of said casing pipe:

- a pressure-resistant, leak-proof, metallic central tubing string, made-up of joints coupled together, end to end, by threaded couplings, and hung in the well-head,
- a coaxial annular layer of nanoporous super-insulating fibrous or granular materials, of very low density, filled with gas at near atmospheric pressure, and presenting a highly reduced radiant heat transfer,
- a coaxial sealed insulation cover and support tubing string, also hung in the well-head, made-up of thin-gauge metal joints, welded or brazed together, surrounding said annular layer of super-insulating material and said thin-gauge metal joints presenting a flexible annular support welded respectively to the outer surface of said central tubing and to the inner surface of said insulation cover tubing, at the respective two ends of each joint of said tubings,
- a plurality of wire-type metal centralizers, affixed to each

joint of said central tubing, within its associated thin-gauge metal joint and each said centralizer presenting a radial extension, sliding into a rail guide affixed to the inner surface of said thin-gauge metal tube, parallel to its axis,

- a coaxial pressure-resistant protective metallic tubing string, made up of tight joints, coupled by metal to metal threads at each of their two ends, also hung in the well-head and presenting an inner diameter slightly greater than the outer diameter of said sheet metal tubing string,
- two coaxial stinger tubes, equipped with heat-resistant seals, for insertion of each of them into a matching polished-bore-receptacle, respectively at the lower ends of said central metallic tubing string and of said coaxial outer protective metallic tubing string.

101.(NEW) The dedicated super-insulated tubular assembly of claim 100, wherein:

the sealed annular enclosure of said super-insulating materials, comprises:

- A. metal wire centralizers, or radial extensions,
- B. longitudinal metal guides, rails or grooves,
- C. thin-gauge metal tubulars, and
- D. metal flexible annular supports,

together with either the outer surface or the inner surface of an adjacent steel tubular, and wherein,

- said metals are selected alloys, including two or more metals, taken from the following alphabetic list:

Aluminum, Antimony, Cadmium, Copper, Chrome, Iron, Manganese,

Molybdenum, Nickel, Silicon, Silver, Titanium, Vanadium and Zinc, and the metalloids Carbon and Nitrogen, in small concentrations, for their cost, and respective compatibilities, and for their main relevant properties, within the temperature range of 100 C to 360 C, said properties being listed below:

- ease of assembly by welding, brazing, or soldering,
- maximum elongation, by cold-working of said alloys in dies,
- high structural strength, ductility, and fatigue resistance, of said thin-gauge metal tubulars,
- low thermal conductivity and low thermal expansion, relative to those of high-strength steel or of plating metals of said steel tubulars.

102.(NEW) A modified version of the super-insulated steam tubular assembly joints of claim 100, also pre-fabricated,

wherein,

- said outer protective tubing joint, is used as the main structural support of the super-insulation and of said insulation cover tube, made of thin-gauge metal, and as a substitute to the inner steam tubing,

wherein,

- a jointless coiled-tubing string, straightened by conventional means, is inserted within said welded insulation cover tube, thereby eliminating the risk of steam leaks, present in jointed tubulars, at high temperatures,

and wherein,

- A. said wire-type centralizers are affixed on the inner surface of said protective tubing joint, with their radial extensions pointing

inward,

- B. said extensions are sliding in rail guides affixed to the outer surface of the thin-gauge metal cover tube, of diameter only slightly larger than that of said coiled-tubing,
- C. said flexible annular end-supports of the thin-gauge metal cover tube are affixed respectively on the inner surface of the protective tubular, and on the outer surface of said thin-gauge metal cover tube, thereby sealing the insulation inside a thin-gauge metal annular enclosure, fully protected from external shocks, by the thick outer protective pipe,
- D. the annular space between said coiled-tubing outside diameter and the drift diameter of said thin-gauge metal insulation cover tubes, does not exceed one sixteenth of an inch, plus a plurality of pairs of grooves containing jointless stainless steel micro-tubes of one quarter-inch diameter, protecting fiber-optic or electronic cables linking recorders at the well-head to downhole sensors, of temperatures, pressures, humidity and other control parameters of the fluids flow-rates and heat transfer processes, in the entire system,
- E. a low-pressure slip-stream of dry oil-lifting fluid, filling said annular space, in case of a small leak, carries away and prevents any potential moisture leakage from contacting said insulation.

103.(NEW) The coiled-tubing, used as the steam tubing string in claim 102, is preferably made of a seamless tube of Titanium alloy, laser-welded, or of a cheaper, Induction-welded, Chrome and Nickel alloy steel, wherein:

- said jointless coiled-tubing is equipped at its lower end with a sealing stinger matching an associated polished-bore-receptacle

above the packer of the uppermost apparatus, leading to the central insulated steam tubing, previously hung within the stack of all the branch-wells' apparatus.

104.(NEW) The apparatus of claim 100, wherein the cold oil-lifting fluid, mostly composed of water-free, mixed, light hydrocarbons, when re-heated, is partly miscible with the heated and produced heavy-oil and carried to the surface by means of artificial-lift devices, as both gas and liquid phases.

105.(NEW) The apparatus of claim 100, wherein said oil-lifting fluids are in a gas phase and said artificial-lift devices are conventional, wireline-retrievable gas-lift valves, set in regular gas-lift valve mandrels and operated by the density difference of said gas phase versus the densities of said heated oil and of said steam condensate, wherein:

- the temperature of said oil-lifting fluids is closely monitored by appropriate sensors located downhole and recorded at the surface, throughout the operation of each of the branch-wells, until said oil-lifting fluids return to the surface, to be separated out as part of the boiler-fuel, and used to generate steam.

106.(NEW) A method of producing viscous heavy-oil from a cool reservoir located below a cold environment, into a multilateral well equipped with a plurality of branch-wells, said multilateral well having a cemented casing traversing said environment and connecting to liners of said branch-wells, located below said environment, said method including the steps of:

a) sub-cooling said cemented casing with a compressed gas stream, colder than said environment, flowing downward in the annular space, herein designated as a first fluid-flow compartment, located between the inner surface of said cemented casing and the outer surface of a thermally-insulated intermediate pipe of smaller diameter than said casing's inner surface,

b) re-heating said cold gas-stream by adding it to a mixture of hot liquid production stream, flowing upwards from most of said branch-wells and of a very hot condensate stream, coalesced from a stream of wet steam, flowing downwards in a thermally-insulated tubing, located on the axis of said casing and on the axis of at least one other branch-well, from which said wet steam, partially separated from said condensate, is injected into a portion of said cool reservoir, via the tubing of a first-steamed injector branch-well,

c) subsequently stopping the steam injection in said first-steamed branch-well, and transferring said steam injection to a second-steamed branch-well, to let the first injector's steam to rise up, by gravity within said reservoir, above said first injector branch-well, thereby heating said reservoir's portion and reducing the viscosity of all its fluids content, during a steam-soaking period, in which the heated liquid fluids (oil, water and condensate) flow in counter-current of the rising steam, first within said reservoir portion and then into a horizontal part of the first-steamed branch-well's curved tubing,

d) subsequently gas-lifting said heated liquid fluids into the curved part of the tubing of said first-steamed branch-well, up to said curved tubing's junction with a shared annular collector channel, in a thermally-insulated space, gas-filled at near-atmospheric pressure,



herein designated as a second fluid-flow compartment, located between two coaxial thermal barriers, said collector channel being always open to all producing branch-wells and up to the end of said channel, at the well-head, and connected to multiple parallel tubings via flow-control devices for, sequentially, switching each branch-well to different operating modes,

e) separating the gas phase (gas-lift gas and solution gas) from the gas-lifted liquid phases (hot oil and water) in a three-phase separator system, at the surface,

f) piping the separator off-gas phase to the boiler-fuel feed manifold to generate a large portion of the required steam, the remainder of said required steam being supplied by an additional portion of said compressed cold gas supply stream,

g) treating most of said separated hot water phase for making it into the supply of boiler feed-water, and using excess water for heating facilities at the surface, and for waterflooding other reservoirs,

h) disposing of waste streams (boiler sludge, chemicals, etc...) in a shallow disposal well,

i) shipping the off-separator, hot heavy-oil phase, to mix it with lighter crudes from other reservoirs, thereby making a mixture suitable for pipeline and tanker transportation to a refinery,

j) successively repeating the same sequence with various other branch-wells, optimizing the respective durations of the main periods, respectively: steam-soaking, lasting a few days,

steam-injection, lasting a few weeks,

oil producing, lasting several months, and

depending upon: the number of available branch-wells, connected to said multilateral well, the characteristics of said heavy-oil

reservoir, the heat transfer rates and the tubulars length and sizes, for each particular case, from operating data collected and recorded from multiple sensors, at the surface and downhole, within a thin, but important, annular space between said second thermal barrier, herein designated as a third fluid-flow compartment, and the steam-filled tubing string, herein designated as a fourth fluid-flow compartment of the multilateral well.

107.(NEW) The method of claim 106, for injecting wet steam, made on-site via one or more of said branch-wells in said heavy-oil reservoir, via a dedicated and shared "super-insulated" steam tubular assembly, coaxially located within said vertical cased well, said method including the following steps:

a) opening a steam valve at the well-head, from the insulated goose-neck steam supply line pipe from a boiler, to the axial jointless tubing located within a thin metallic cover tubing around said thermally-insulated steam tubing, said annular space between said insulation cover tubing and said jointless steam tubing being filled with gas circulating up and down at near-atmospheric pressure, in a third fluid-flow compartment instrumented for optimizing the durations of respective steps b), c), d), e), f) and j), of claim 100, so as to maximize the heavy-oil average production rate, in daily Barrels per daily million BTU of cold gas, consumed by said multilateral well,

b) opening a valve, located downhole, on a slanted connecting pipe, linking the steam-filled axial pipe to the tubing of the branch-well selected as second-steamed injector,

c) closing the annular space between liner and tubing at the lower end of the curved part of the selected branch-well by applying

fluid-pressure on the upper face of its cup-packer, thereby preventing any back-flow of steam above said cup-packer, during the steam injection period and the steam-soaking period.

108.(NEW) The method of claim 106, wherein:

- the fluid filling said first fluid-flow compartment is always a downhole-flowing stream of dry boiler-fuel, gaseous or liquid, of high fluidity and low market value, at a below-freezing temperature, with a flow rate and a temperature remaining almost constant, and

wherein,

- on the contrary, the streams of warm fluids, filling said annular production tubing are periodically changing, thereby creating thermal stresses which, in deep wells, handling corrosive heavy-oils, might reach, after many repeated stress cycles, the fatigue limits of the metals used in said multilateral well; heavy-oils rich in wax and asphaltenes might also plug-off the well's tubings and even the sand face, so additional preventive steps will extend those of claim 106:

- A) interrupting downhole the production flow stream from the horizontal branch-well annulus, by closing a lift-gas supply valve, or inserting a corresponding wireline-retrievable plug and

- B) compressing, warming and injecting into the branch-well lift-gas tubing, a downhole-flowing mixed stream of said boiler-fuel, gas or liquid, re-heated by heat-exchange with very hot steam condensate, separated-out from wet steam, and dehydrated, at the surface,

- C) injecting said dry mixed stream into the annular space of the branch-well for a short oil-cleaning period, thereby displacing warm gas in the annular production tubing, and in the annular space of the horizontal branch-well, prior to steam injection, via the branch-well

tubing, and trapping some of the said warm gas in both the branch-well tubing and its surrounding annular space, for a period of a few days,

D) gradually increasing the heat transfer rate to the branch-well's horizontal and curved tubings and to the perforated horizontal liner string of the branch-well, and pre-heating the reservoir around the horizontal branch-well, before reaching the full rate of steam injection,

E) injecting, at full rate, a downhole-flowing stream of wet steam in said branch-well, for a selected period, of about a few weeks

F) closing the steam valve at the well head, for a short steam soaking period, of a few days, to form a steam chest, in the reservoir,

G) returning the multilateral well to its original branch-well oil-flow configuration, and, finally:

H) starting a new cycle of heavy-oil production, lasting at least several months, or longer, depending upon the porous volume and other characteristics of said reservoir portion, and lasting until the heavy-oil production rate from said branch-well rapidly declines, due to shrinkage of the steam chest, by steam condensation, within the actual drainage volume of the branch-well.

109.(NEW) The method of claim 106, wherein:

the gas filling said second fluid-flow compartment is dry Nitrogen gas, at a near-atmospheric pressure, so as to further reduce the residual heat transfer from said production collector pipe, via said first thermal barrier to said first flow-compartment.

110.(NEW) The method of claim 106, wherein:

the gas filling said third flow compartment, of very small volume, is pure dry Argon gas, at a near-atmospheric pressure, so as to further reduce the residual heat transfer, via said second thermal barrier to said second fluid-flow compartment, and also to detect, by spectral analysis of said Argon gas, any leak of steam, or of Nitrogen gas, or of Methane gas, from the other, higher-pressure fluid-flow compartments, or to detect any Hydrogen gas resulting from corrosion of the metals of any of the pipes surrounding said third fluid-flow compartment.